

IN THE CLAIMS

1. (Currently Amended) A method of manufacturing a rigid foam board consisting essentially of:

incorporating nano-particle nucleating agents into a polymer melt, said nano-particle nucleating agents being selected from the group consisting of nanosheets of graphite, intercalated graphites and expanded graphites and having a particle size in at least one dimension of less than 100 [angstroms] nanometers;

incorporating a blowing agent into the polymer melt under a first pressure and at a first temperature;

extruding the polymer melt under a second pressure and at a second temperature, the second pressure and second temperature being sufficient to allow the polymer melt to expand and form a foam board having a solid foam structure; and

cooling the foam board, said foam board having an average cell size between 60 μm and 120 μm and having a cell size distribution;

wherein said polymer melt includes an alkenyl aromatic polymer material. [;]
[wherein no nucleating agents other than said intercalated graphites and expanded graphites are incorporated into the polymer melt; and]

2. (Previously Presented) A method of manufacturing a rigid foam board according to claim 1:

wherein the polymer includes at least one alkenyl aromatic polymer selected from alkenyl aromatic homopolymers, copolymers of alkenyl aromatic compounds and copolymerizable ethylenically unsaturated comonomers.

3. (Previously Presented) A method of manufacturing a rigid foam board according to claim 2:

wherein the polymer includes a major portion of at least one alkenyl aromatic polymer selected from the group consisting of the polymerization products of styrene, α -methylstyrene, chlorostyrene, bromostyrene, ethylstyrene, vinyl benzene and vinyl toluene; and

a minor portion of a non-alkenyl aromatic polymer.

4. (Previously Presented) A method of manufacturing a rigid foam board according to claim 3:

wherein the polymer includes at least 80 wt% polystyrene.

5. (Previously Presented) A method of manufacturing a rigid foam board according to claim 2:

wherein the blowing agent includes at least one composition selected from aliphatic hydrocarbons having 1-9 carbon atoms, halogenated aliphatic hydrocarbons having 1-4 carbon atoms, carbon dioxide, nitrogen, water, azodicarbonamide and p-toluenesulfonyl.

6. (Previously Presented) A method of manufacturing a rigid foam board according to claim 5:

wherein the blowing agent includes at least one composition selected from methane, methanol, ethane, ethanol, propane, propanol, n-butane, isopentane, carbon dioxide, nitrogen, water, azodicarbonamide, p-toluenesulfonyl, HCFC-142b and HCFC-134a.

7. (Previously Presented) A method of manufacturing a rigid foam board according to claim 2, further comprising:

incorporating an additive into the polymer melt before forming the foam.

8. (Previously Presented) A method of manufacturing a rigid foam board according to claim 7:

wherein the additive includes at least one composition selected from flame retardants, mold release agents, pigments and fillers.

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10. (Previously Presented) A method of manufacturing a rigid foam board according to claim 2:

wherein the nano-particles are incorporated into the polymer melt at a rate between 0.01 and 10 weight percent, based on polymer weight.

11. (Previously Presented) A method of manufacturing a rigid foam board according to claim 2:

wherein the nano-particles are incorporated into the polymer melt at a rate between 0.5 and 5 weight percent, based on polymer weight.

12. (Previously Presented) A method of manufacturing a rigid foam board according to claim 11:

wherein the polymer includes a major portion of polystyrene, polyethylene or polymethyl methacrylate.

13. (Previously Presented) A method of manufacturing a rigid foam board according to claim 10:

wherein the nano-particles are formed by a technique selected from intercalation with polystyrene and exfoliation of expandable graphite particles in a polystyrene or polymethyl methacrylate matrix.

14. (Previously Presented) A method of manufacturing a rigid foam board according to claim 2, wherein:

the average cell wall thickness is less than about 10 μm ;

the average strut diameter is less than about 20 μm ;

the cell orientation is between about 0.5 and 2.0; and

the foam density is less than about 100 kg/m^3 .

15. (Previously Presented) A method of manufacturing a rigid foam board according to claim 14, wherein:

the average cell wall thickness is between about 0.2 and about 1.0 μm ;
the average strut diameter is between about 4 and about 8 μm ;
the cell orientation is between about 1.0 and about 1.5; and
the foam density is between about 20 and about 50 kg/m^3 .

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27. (Newly Presented) A method of manufacturing a rigid foam product comprising:

incorporating nano-graphite nucleating agents into a polymer melt in an amount between about 0.01 and 10 weight percent, based on polymer weight, said polymer melt including an alkenyl aromatic polymer material and said nano-graphite nucleating agents having a particle size in at least one dimension of less than 100 nanometers and being selected from the group consisting of nanosheets of graphite, intercalated graphite and expanded graphite;

incorporating a blowing agent into the polymer melt under a first pressure and at a first temperature;

extruding the polymer melt under a second pressure and at a second temperature, the second pressure and second temperature being sufficient to allow the polymer melt to expand and form a foam product having a solid foam structure; and

cooling the solid extruded foam product.

28. (Newly Presented) The method according to claim 27, wherein said cooled solid extruded foam product has a mean cell size of several tens of microns to several hundred microns.

29. (Newly Presented) The method according to claim 27, wherein the polymer includes at least one alkenyl aromatic polymer selected from alkenyl aromatic homopolymers, copolymers of alkenyl aromatic compounds and copolymerizable ethylenically unsaturated comonomers.

30. (Newly Presented) The method according to claim 29, wherein the polymer includes a major portion of at least one alkenyl aromatic polymer selected from the group consisting of the polymerization products of styrene, α -methylstyrene, chlorostyrene, bromostyrene, ethylstyrene, vinyl benzene and vinyl toluene.
31. (Newly Presented) The method according to claim 27, wherein the blowing agent includes at least one composition selected from aliphatic hydrocarbons having 1-9 carbon atoms, halogenated aliphatic hydrocarbons having 1-4 carbon atoms, carbon dioxide, nitrogen, water, azodicarbonamide and p-toluenesulfonyl.
32. (Newly Presented) The method according to claim 27, wherein the blowing agent includes at least one composition selected from methane, methanol, ethane, ethanol, propane, propanol, n-butane, isopentane, carbon dioxide, nitrogen, water, azodicarbonamide, p-toluenesulfonyl, HCFC-142b and HCFC-134a.
33. (Newly Presented) The method according to claim 27, wherein said foam product comprises at least 90% closed cells.
34. (Newly Presented) The method according to claim 27, wherein the nano-graphite is incorporated into the polymer melt in an amount between about 0.5 and 5 weight percent, based on polymer weight.
35. (Newly Presented) The method according to claim 27, wherein the rigid foam product has a density ranging from about 10 to about 500 kg/m³.
36. (Newly Presented) The method according to claim 27, wherein the rigid foam product is extruded into the shape of a rigid board.